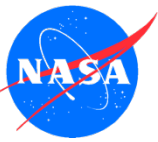


CERES FLASHFlux Status: Near-Real Time Surface Radiative Fluxes and Meteorology for Research and Applications

***Paul Stackhouse, David P. Kratz, and
Takmeng Wong, (NASA LaRC)***

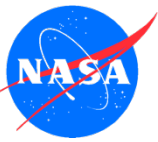
***Shashi Gupta, Parnchai Sawaengphokhai
and Anne Wilber (SSAI)***

***Lindsay Parker and the
Atmospheric Science Data Center Team
(SSAI)***



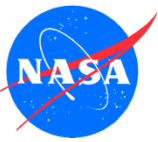
FLASHFlux Update

- ***Brief introduction***
- ***Publications***
 - SSF paper submitted; reviewers comments received
 - State of Climate Methodology and Results
- ***Promotion to v3A: current status***
 - Description of changes: New calibration, New reanalysis
 - GEOS 5.9 (FP-IT), Algorithm upgrades
 - Sample results
 - New web pages
- ***Plans***
 - Near-term promotion of 3A
 - Continued upgrades

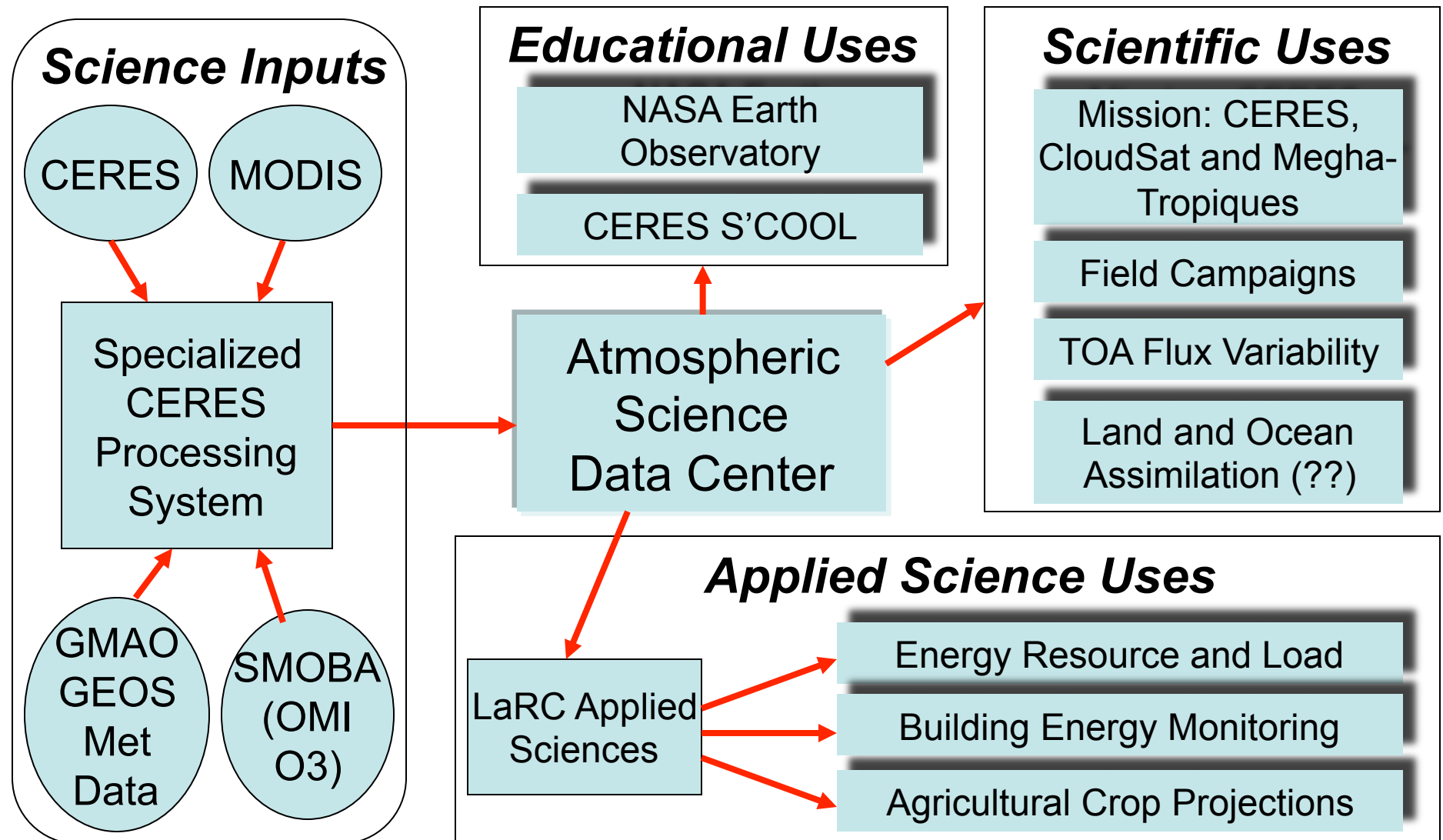


FLASHFlux Overview

- ***FLASHFLUX = Fast Longwave And Shortwave Radiative Fluxes from CERES and MODIS***
- ***FLASHFlux Objectives***
 - Compute radiative fluxes from CERES and MODIS observations from both Terra and Aqua within one week of measurement (currently available within 4 days)
 - Global gridded and time averaged radiative flux and meteorological data sets using both Terra and Aqua when available (currently available within 6 days)
 - Conduct scientific investigations and provide for scientific and applied science uses
 - Demonstrate processing system pushing data products to research and applications uses

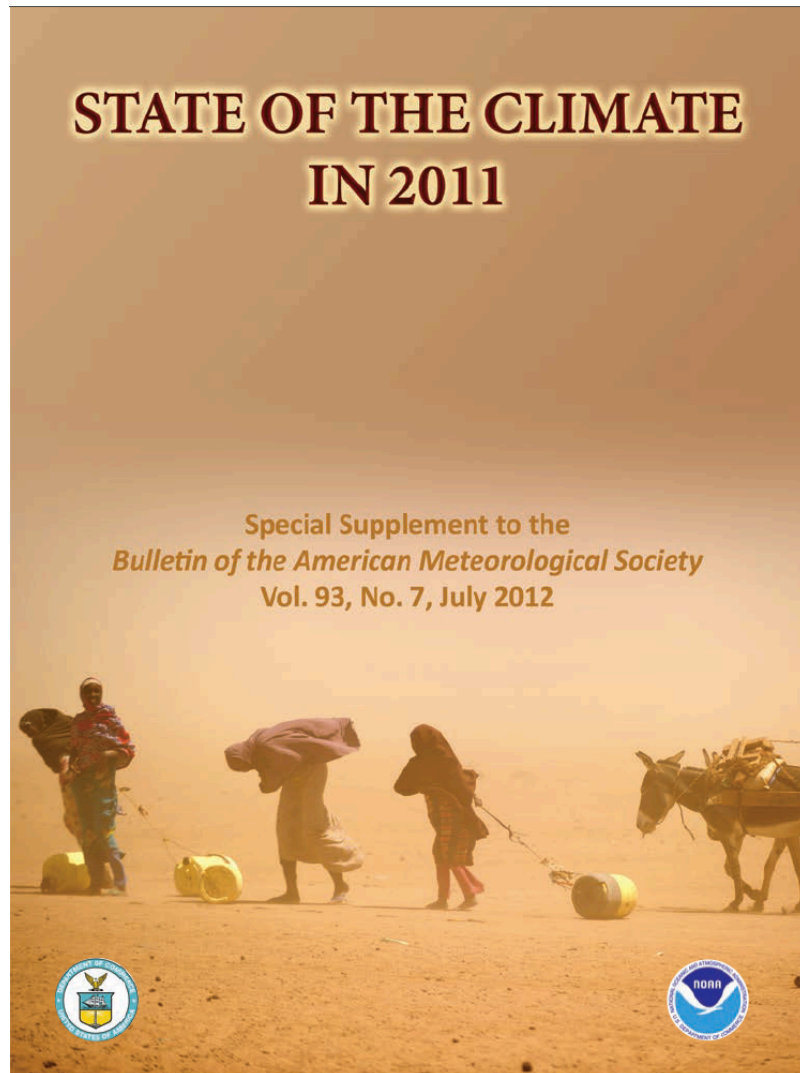


FLASHFLUX: Schematic Mapping to Realized and Potential Uses

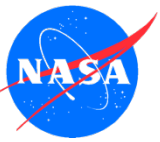




State of the Climate 2012 Analysis



- *CERES FLASHFlux contributed to the special annual BAMS report on the “State of the Climate in 2011”.*
- *Issue appeared in Aug. 2012, providing estimates of changes in year to year Global Earth Radiation Budget for the first time.*
- *These data have now been extended and used longer overlap with CERES EBAF products to contribute to this year’s 2012 report.*

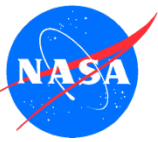


State of the Climate 2012 Analysis

CERES FLASHFlux TOA flux variability for 2011 for BAMS “State of the Climate” report:

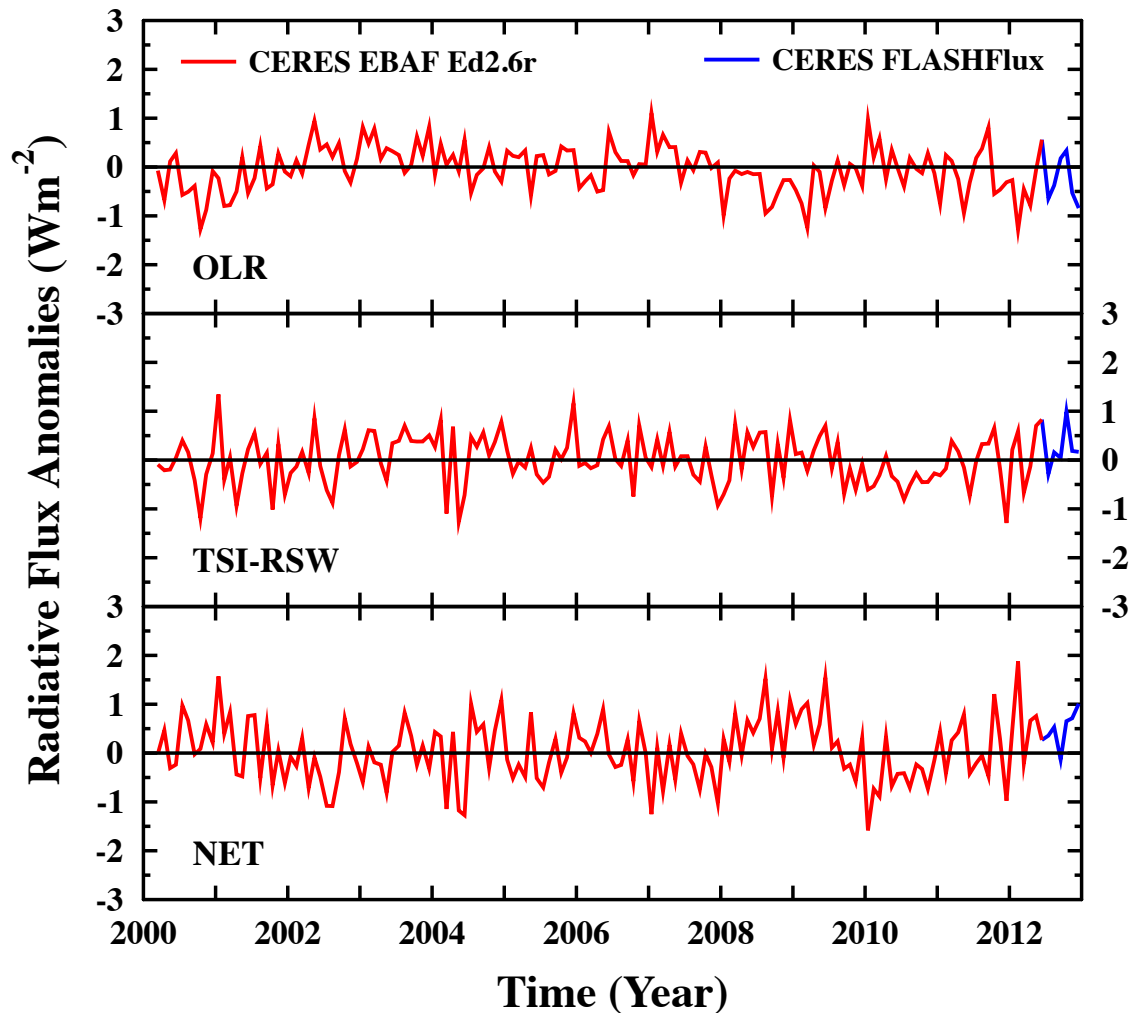
- FF monthly average annual global TOA normalized to EBAF from 7/2009 to 6/2012
 - Needed remove trend in calibration difference
- 2σ monthly uncertainty (W m^{-2}) = $\pm 0.14 \text{ Wm}^{-2}$, $\pm 0.12 \text{ Wm}^{-2}$ and $\pm 0.18 \text{ Wm}^{-2}$ for OLR/RSW/Total net
- TSI from SORCE instrument
- Global annual average anomalies:

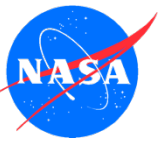
	One year change (2012 minus 2011) (Wm^{-2})	2012 anomaly (relative to climatology) (Wm^{-2})	Interannual variability (2001 to 2011) (Wm^{-2})
OLR	-0.20	-0.35	± 0.55
TSI	+0.05	+0.10	± 0.20
RSW	-0.25	-0.15	± 0.40
Net	+0.50	+0.60	± 0.60



State of the Climate 2012 Analysis

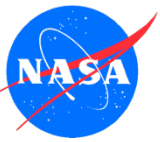
- Time series show relatively large fluctuation
- Variability is consistent with NAO phase change



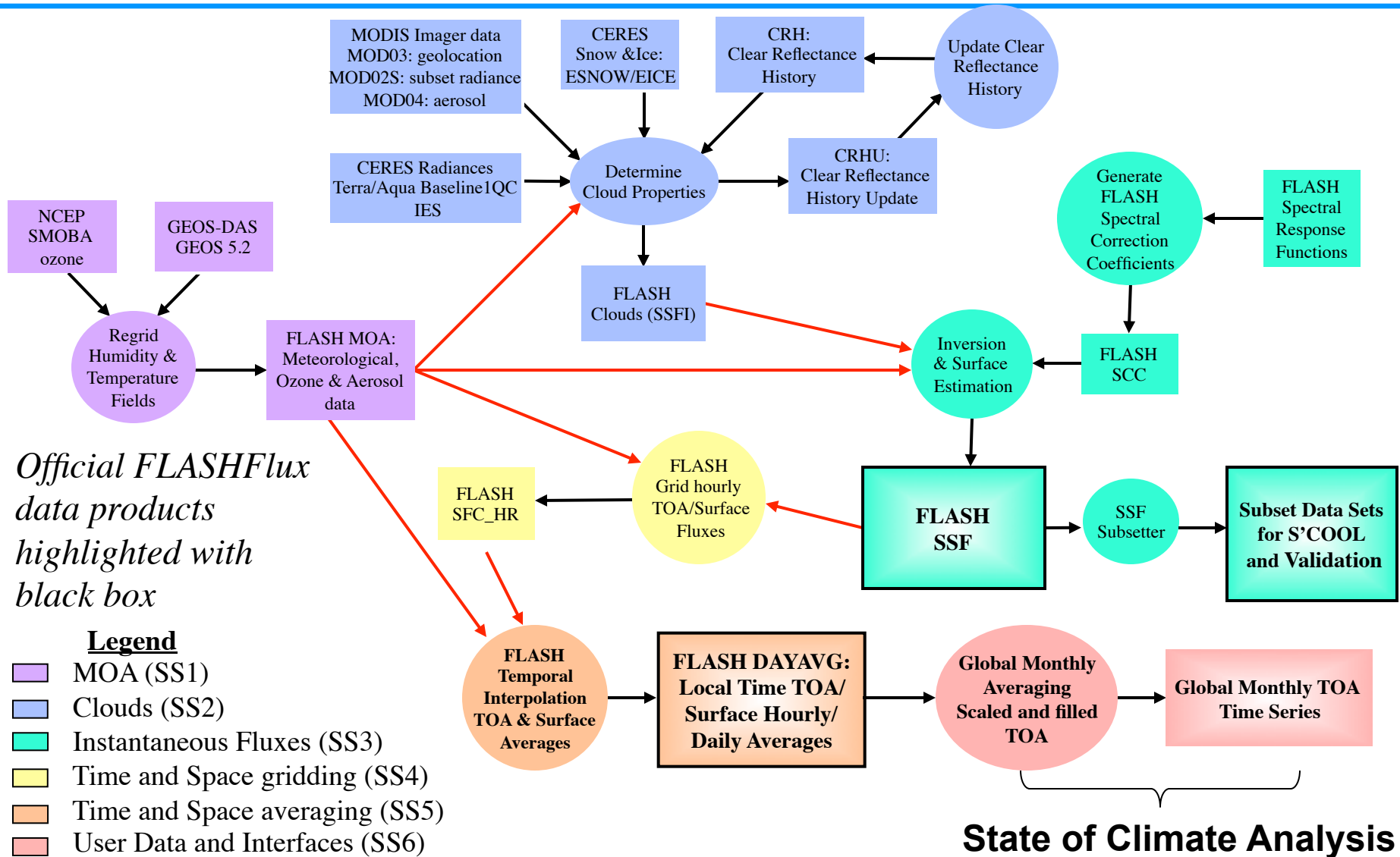


FLASHFlux Upgrade

- ***FLASHFlux v2H upgraded to v3A***
 - Data retroactively processed back to Jan 1, 2013 and processing forward to catch up to real-time
 - Production progressing; data sets publicly available
- ***Upgrade Changes***
 - Calibration upgrade to Ed 3
 - Upgrade MOA to use GEOS 5.9.1 (FP-IT)
 - Using GEOS estimates of ozone profile rather than SMOBA
 - Using AFWA snow/ice maps as processed by CERES
 - Algorithm upgrades
 - SW: Rayleigh scattering revision and MATCH aerosols
 - LW: high surface temperature and inversion corrections

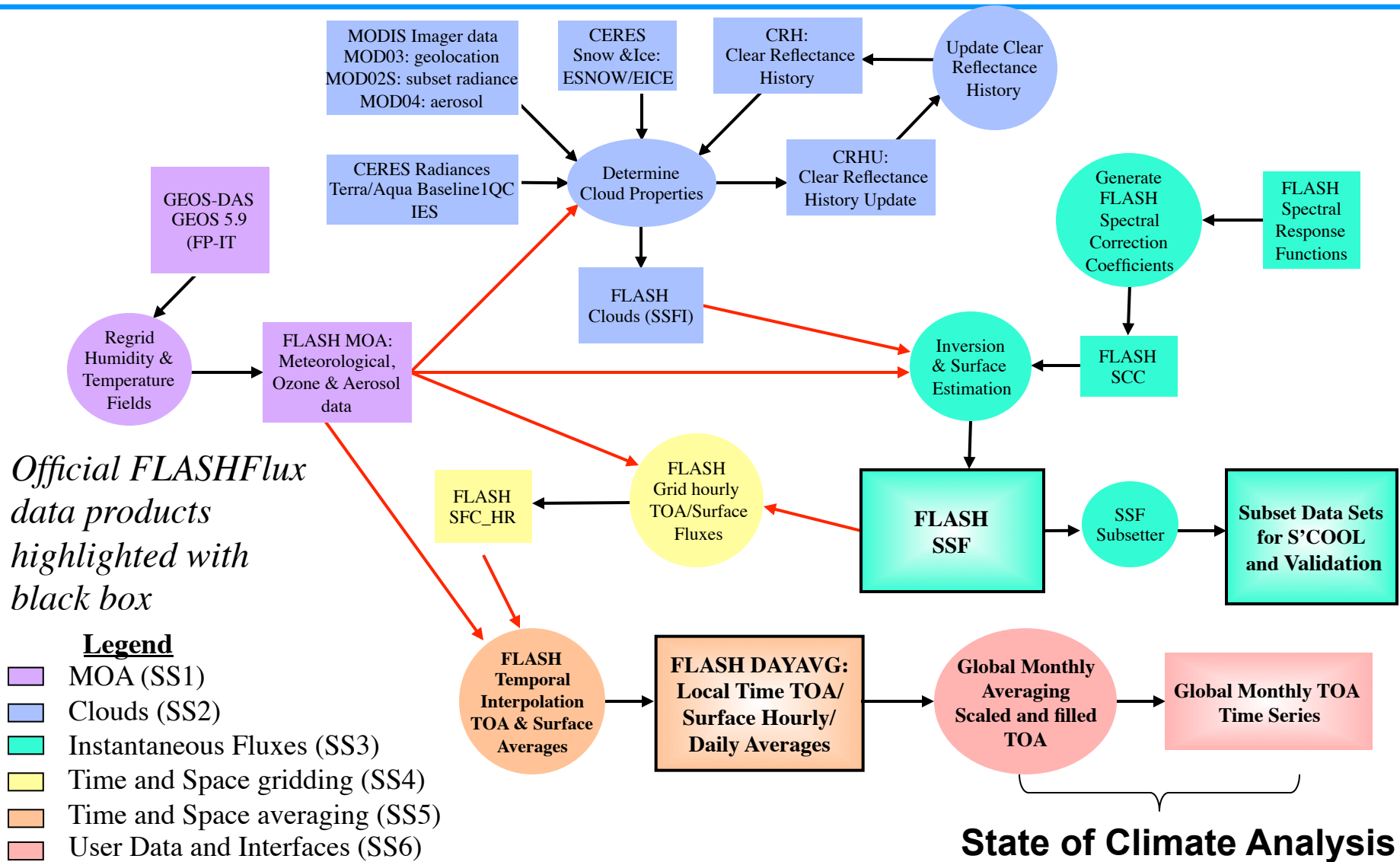


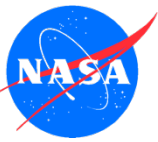
FLASHFlux Data Flow (v2H)





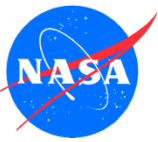
FLASHFlux Data Flow (v3A)





GEOS FP-IT

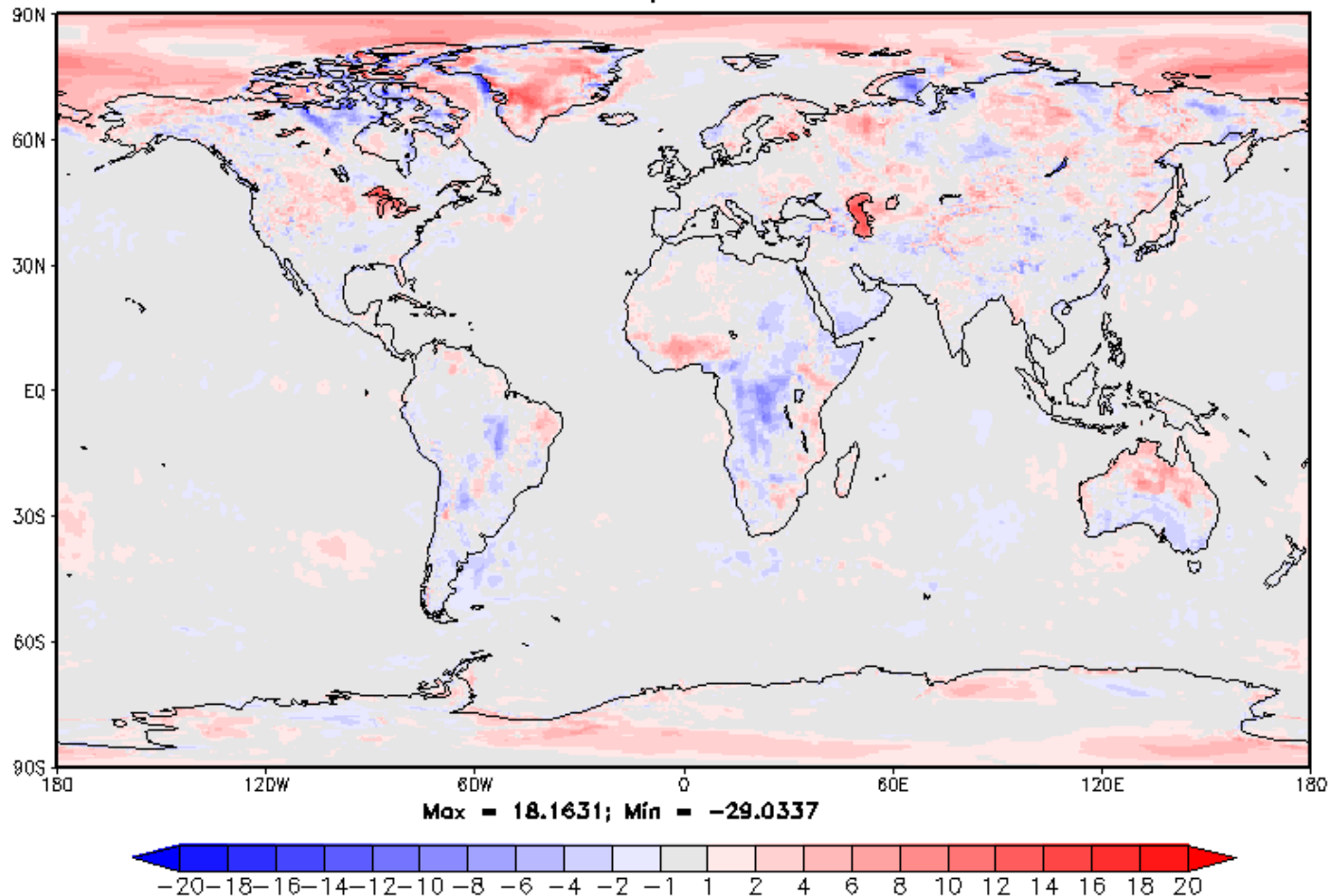
- ***GEOS FP-IT (Forward Processing – Investigative Team)***
 - New GEOS 5.9.1 version replaces operational version GEOS 5.2
 - 0.5° latitude x 0.625° longitude resolution
 - Hourly surface, 3 hourly upper air profile
 - Represents a reprocessed assimilation that is “semi-frozen” with changes before reviewed by the Investigator Team
 - Current being produced from the Jan 1, 2000 to present (3 streams RP-IT1, RP-IT2 and RP-IT3)
 - Production plans to be complete by Fall 2013
- ***Multiple changes from previous versions***
 - Assimilates AIRS radiances among many (HIRS3,4; AMSU-A, B, E; SSM/IS , MHS, IASI, etc. also assimilation GPS)
 - Produces chemistry products such as O3 (SBUV, OMI)
 - Features an aerosol assimilation (AOD MODIS Terra/Aqua)

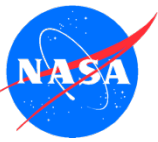


Upgrade to Inputs: FP-IT

global = 0.036308 60-90N = 1.28507 60-90S = 0.35829 20N-20S = -0.223936
20-60N = 0.0616431 20-60S = -0.0508951

GEOS5.9.1 - 5.2 Skin Temperature Diff Mean 01 JAN 2013

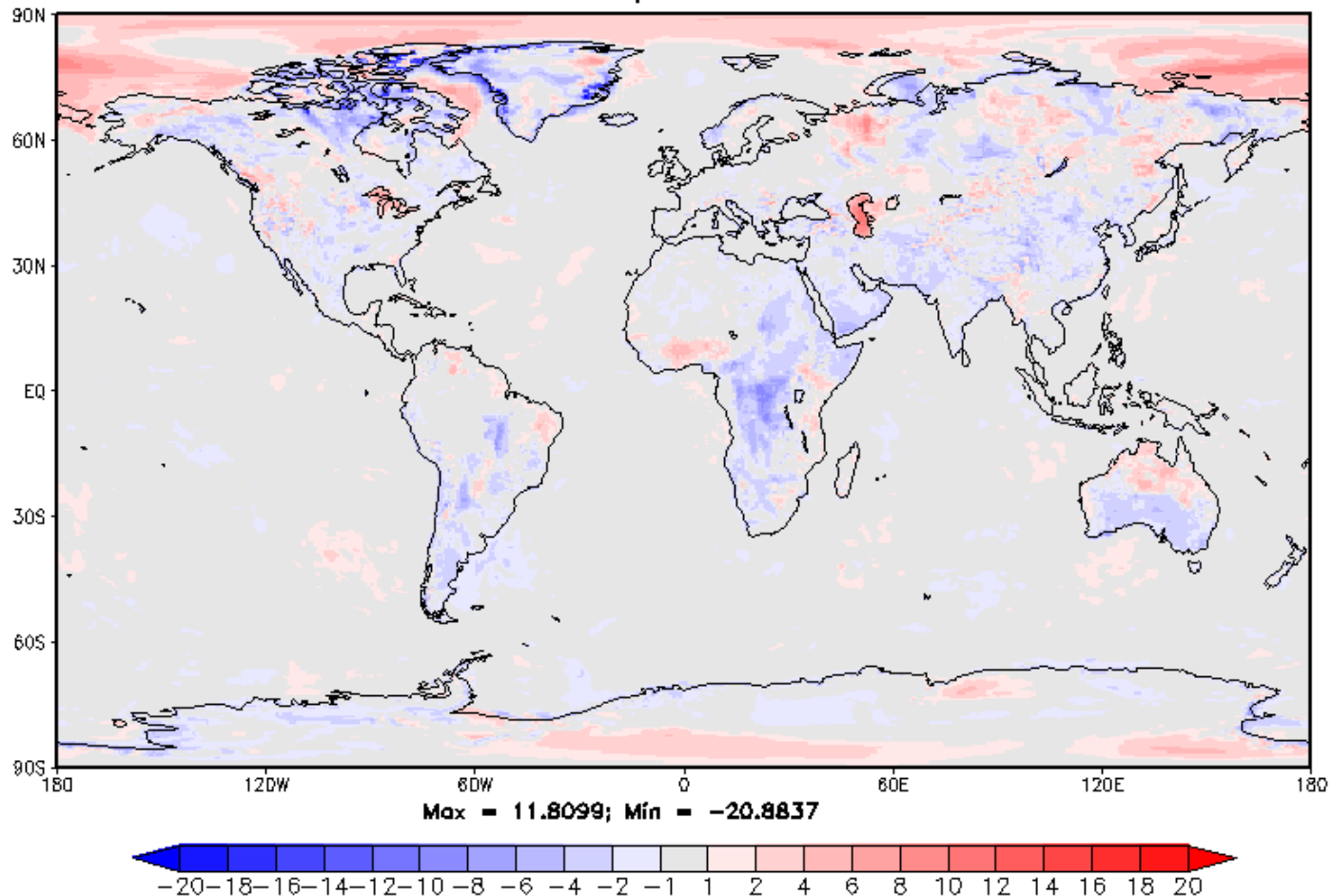




Upgrade to Inputs: FP-IT

global = -0.282821 60-90N = 0.559268 60-90S = -0.186106 20N-20S = -0.305996
20-60N = -0.481144 20-60S = -0.217934

GEOS5.9.1 - 5.2 2M temperature Diff Mean 01 JAN 2013

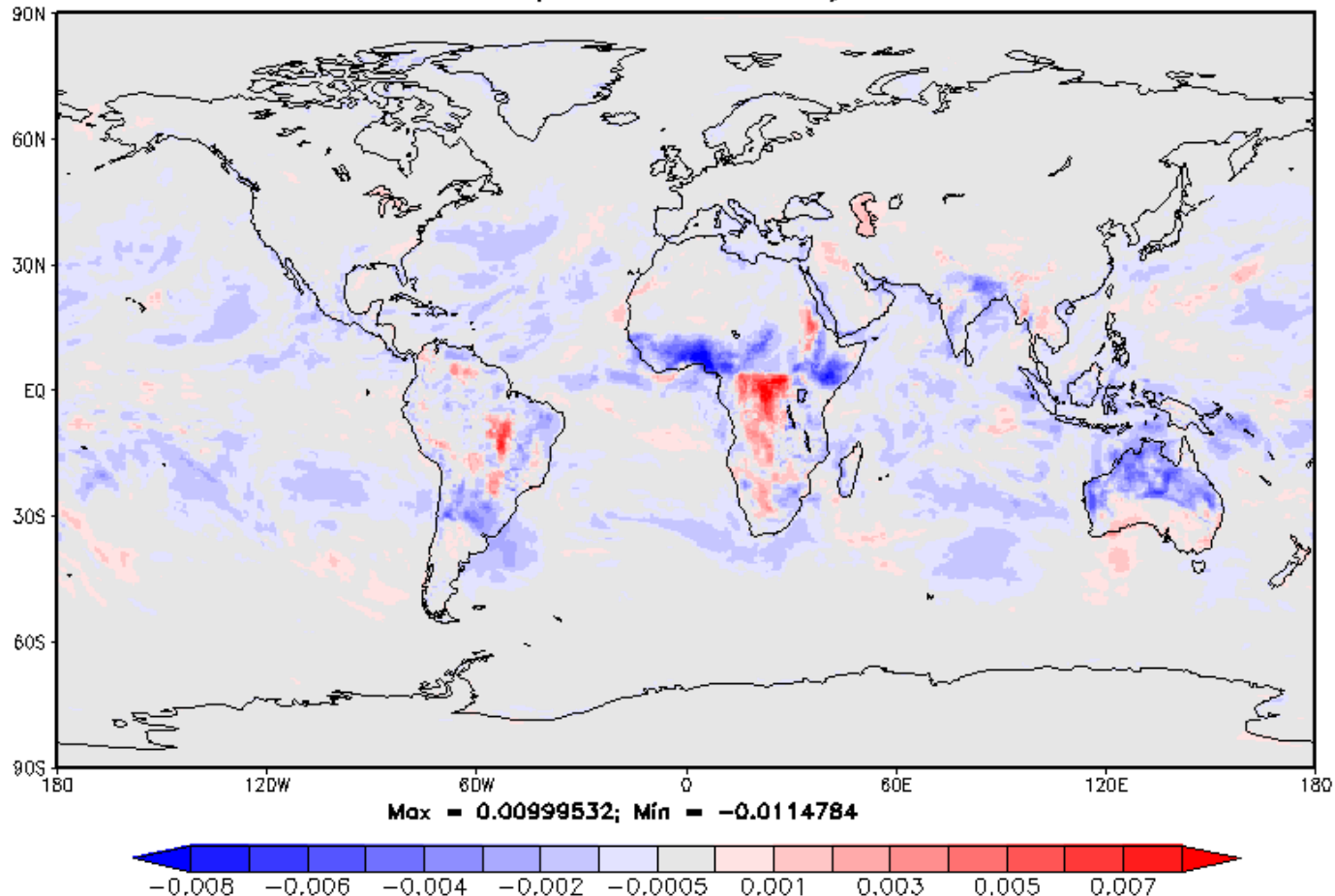


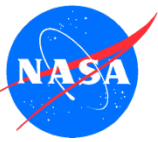


Upgrade to Inputs: FP-IT

global = -0.00035186360 -90N = $1.20961e-050$ -90S = $-5.18297e-05$ N-20S = -0.000605338
20-60N = -0.000199542 -60S = -0.000339997

GEOS5.9.1 - 5.22M Specific humidity DiffMean 01 JAN 2013

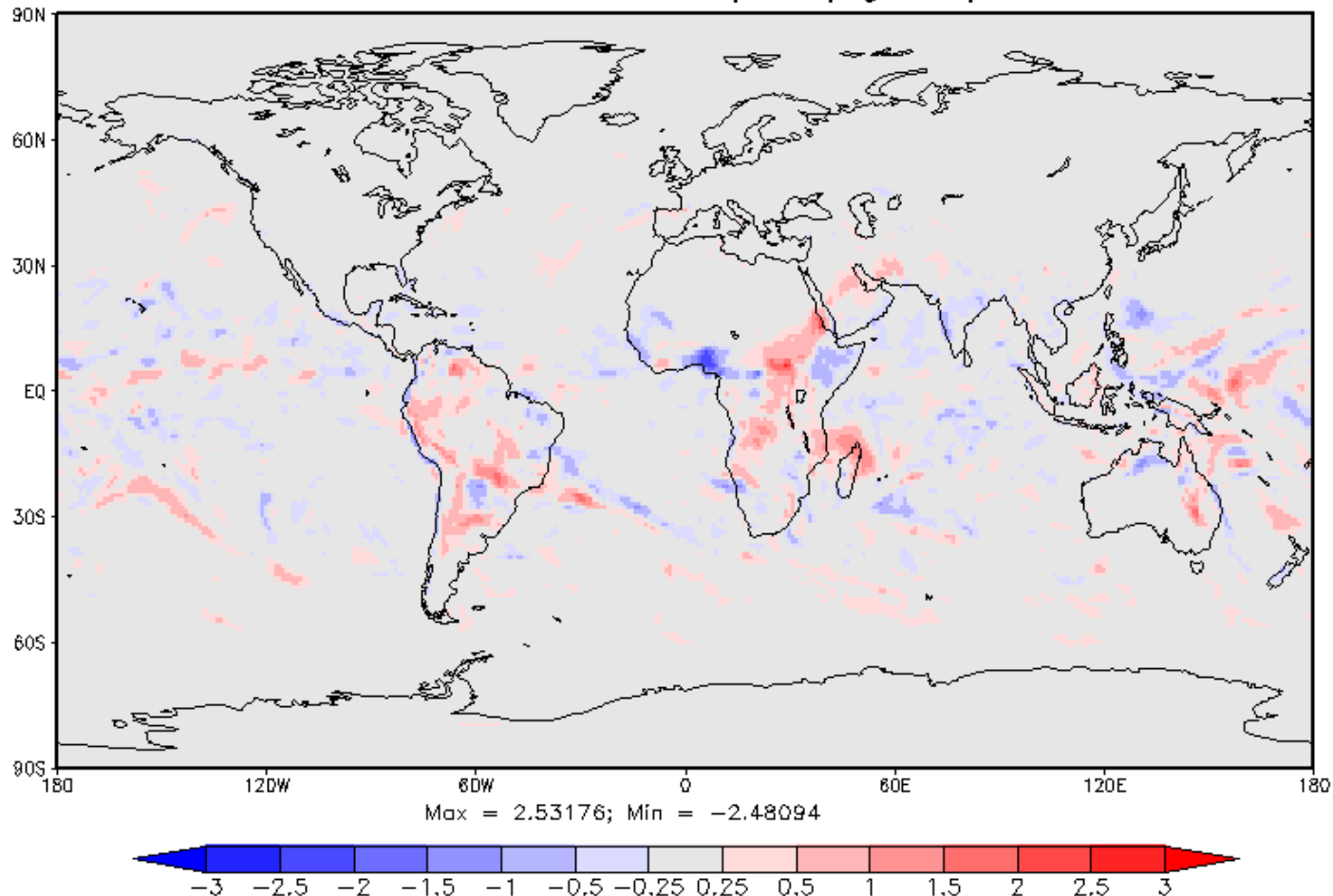


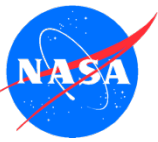


Upgrade to Inputs: FP-IT

global = 0.0348843 60-90N = 0.00456436 60-90S = 0.0417501 20N-20S = 0.0335
20-60N = 0.0253948 20-60S = 0.0520738

GEOS5.9.1-5.2 Column Water Vapor (kg m^{-2}) 03 Jan 2013





FLASHFlux SSF Data Products

***CERES-like Single
Scanner Footprint
(SSF) (Terra and Aqua
overpasses; 30 km
nadir;
2H Processed
through 3/31/2013***

***3A (not available yet)
is processed through
Feb 2013)***

The screenshot shows the NASA Earth Data Atmospheric Science Data Center website. The page title is "FLASH_SSF_Aqua-FM3-MODIS_Version2H". The page layout includes a header with navigation links (Home, Data Descriptions, Order Data, Citing ASDC Data, Help & Resources) and a search bar. Below the header, there is a table of project details:

Project Title:	CERES	Order Data:	ASDC Order Tool: Aqua-FM3-MODIS_Version2H
Discipline:	Clouds	Quality Summary:	CERES FLASHFlux SSF Version2 Quality Summary
	Radiation Budget		
Version:	Version 2H		
Level:	L2		
Platform:	Aqua		
Instrument:	FM3		
Spatial Coverage:	(-90, 90)(-180,180)		
Spatial Resolution:	Footprint		
Temporal Coverage:	Jan 1, 2012 - current		
Temporal Resolution:	Instantaneous		
File Format:	HDF		

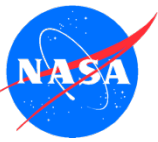
Below the table, there are tabs for "Browse Images", "Parameters", "Order Data", "Read Software", "Product Information", and "Documentation". The "Parameters" tab is selected, showing a list of data products under the heading "TOA Radiances & Fluxes (observed)":

- Shortwave (0-5μm)
- Longwave (5-100μm)
- Window-region (8-12μm)
- Shortwave Flux
- Longwave Flux
- Window-region Flux

Below this list, there are expandable sections for "Surface Fluxes (parameterized)", "Cloud Properties (MODIS)", "Aerosols (MODIS)", and "Auxiliary Data (GMAO GEOS)".

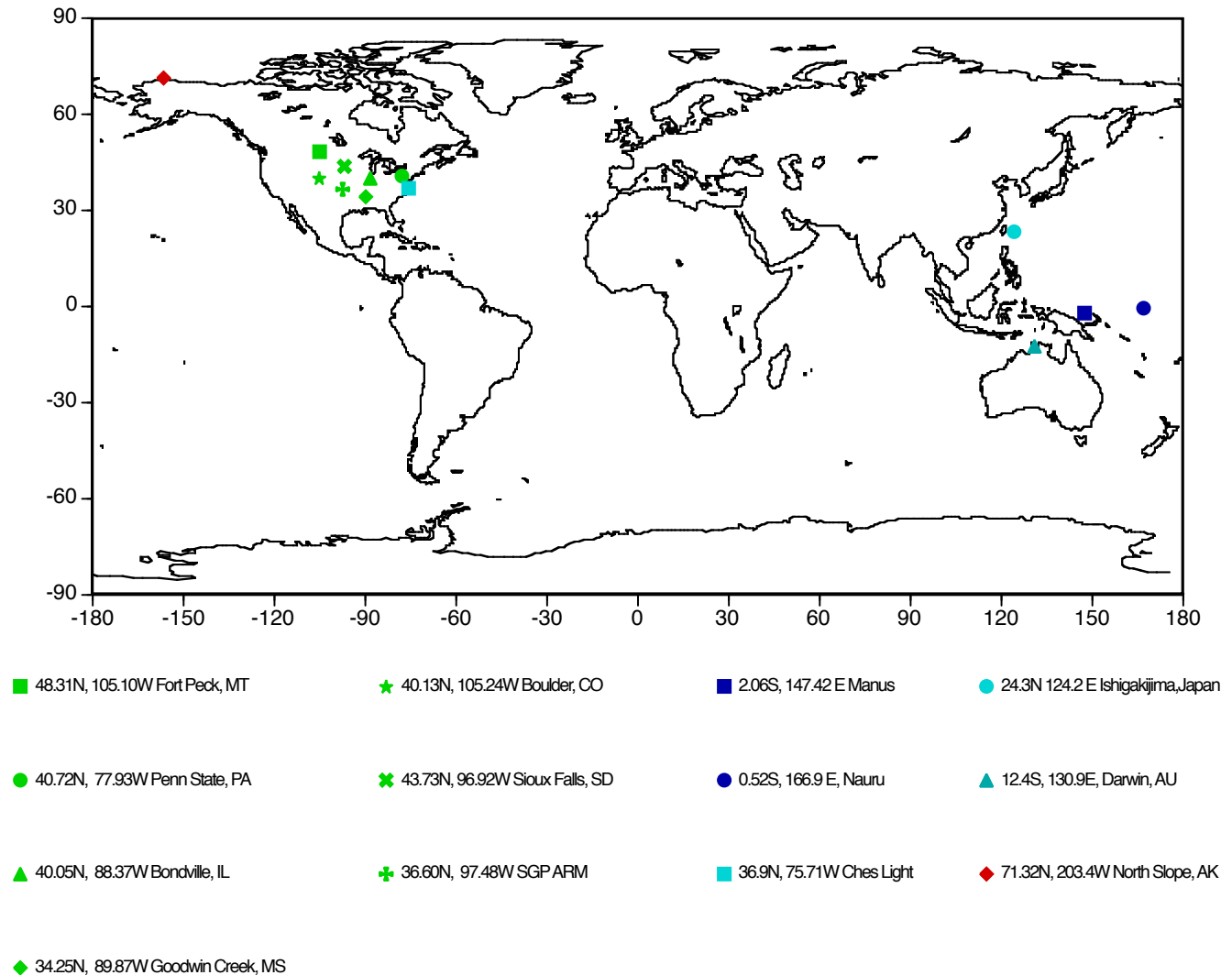
At the bottom of the page, there is a footer with the NASA logo and contact information:

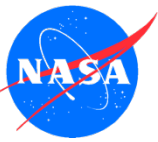
- NASA Official: John M. Kusterer
- Site Curator: NASA Langley ASDC User Services - support-asdc@earthdata.nasa.gov
- NASA Privacy Statement, Disclaimer, and Accessibility Certification
- Copyright Information
- Last Updated: Mon May 06 2013 15:56:29 GMT-0400 (EDT)



Early Surface Flux Validation

Only
SurfRad
and a few
other sites
available
for Jan
2013



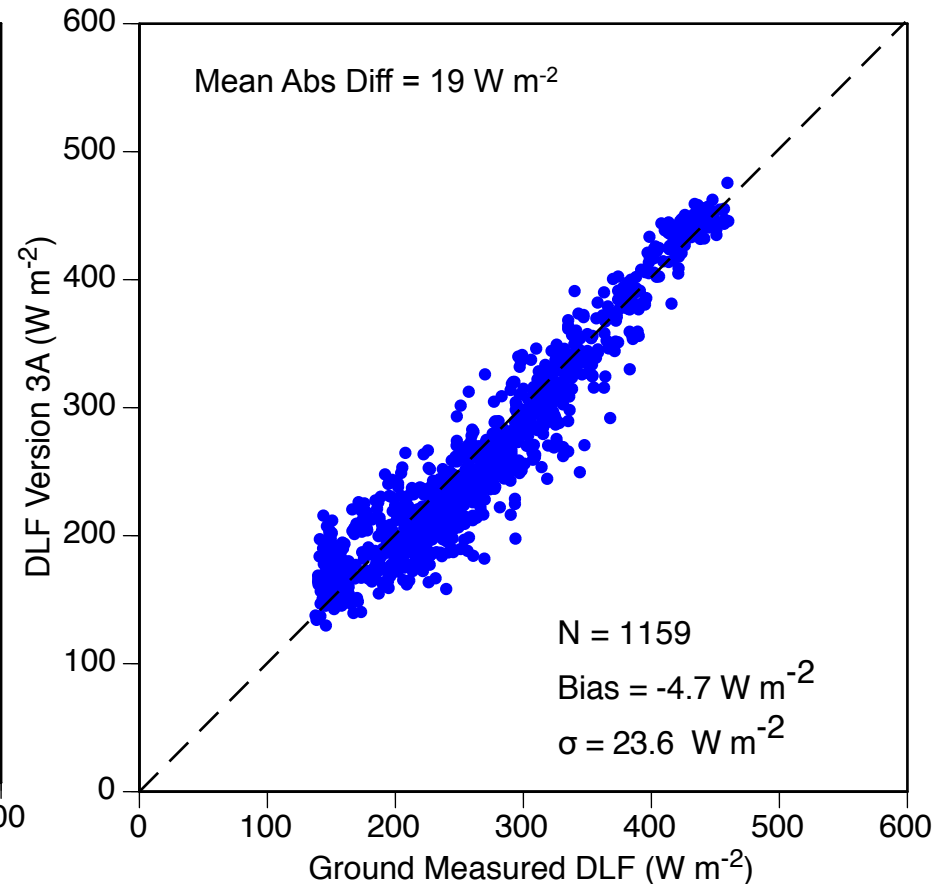
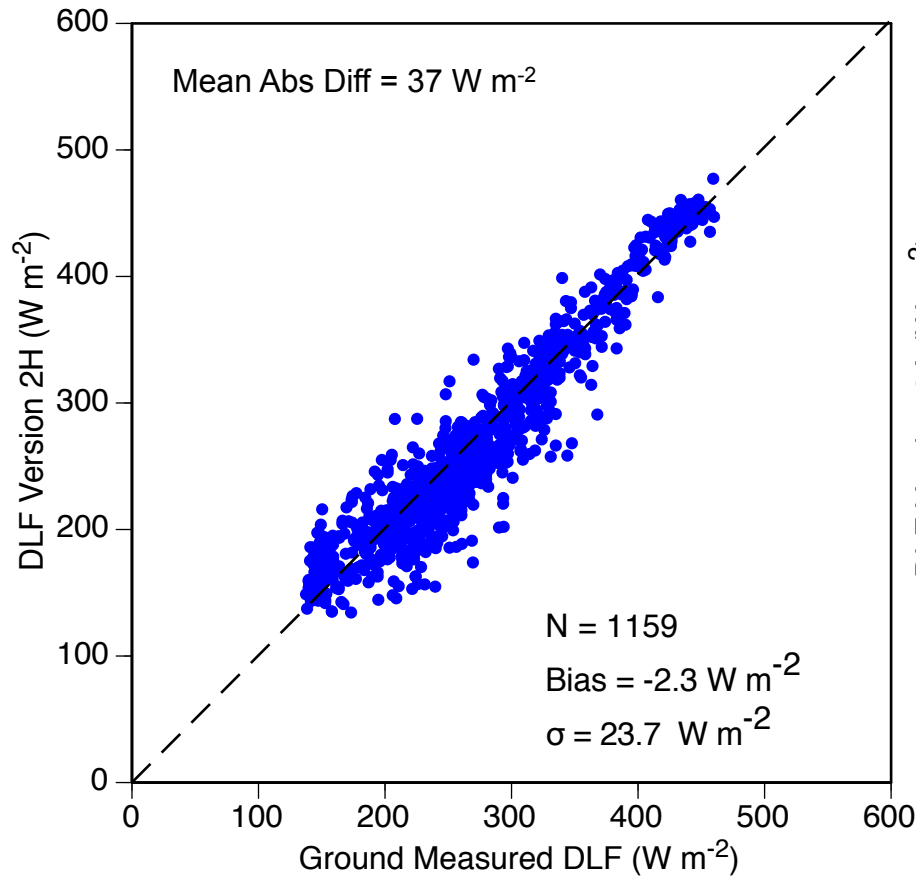


LW SSF Early Validation (Jan 2013)

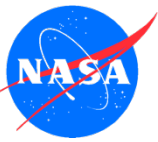
2H

Terra and Aqua

3A



Instantaneous fluxes at overpass times

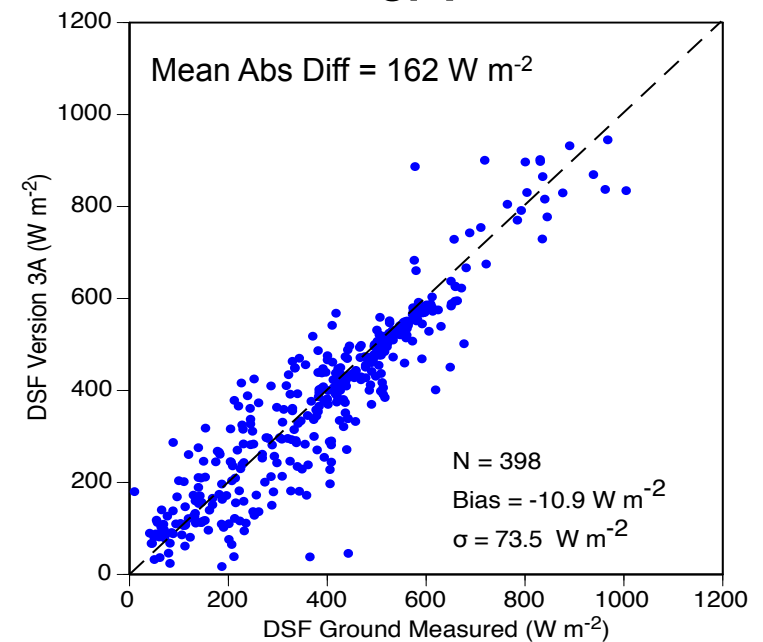
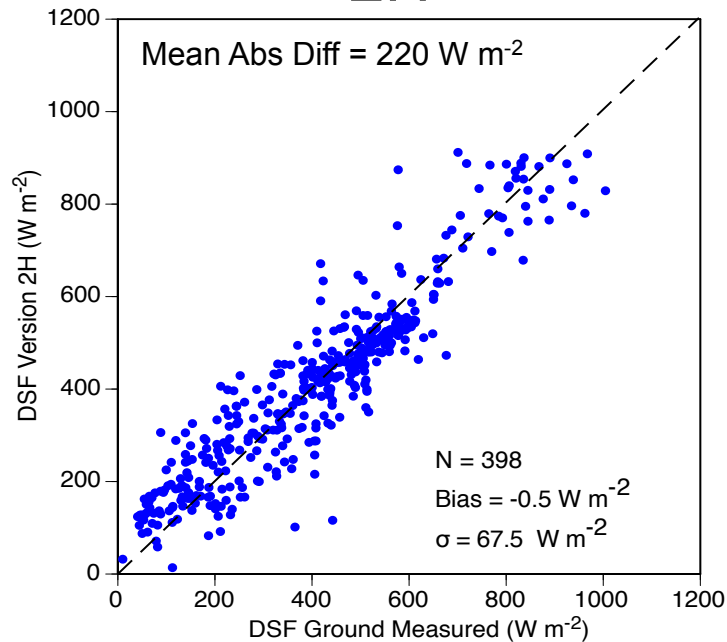


SW SSF Early Validation (Jan 2013)

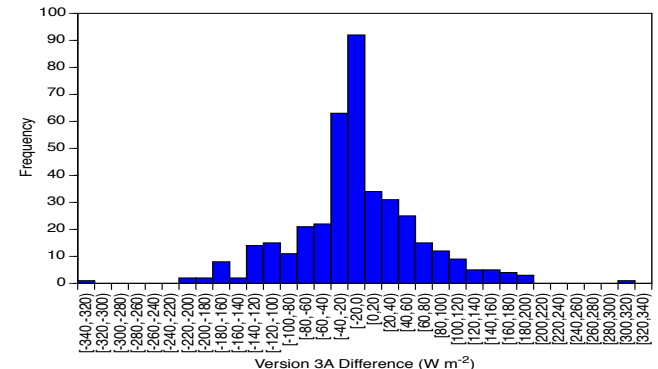
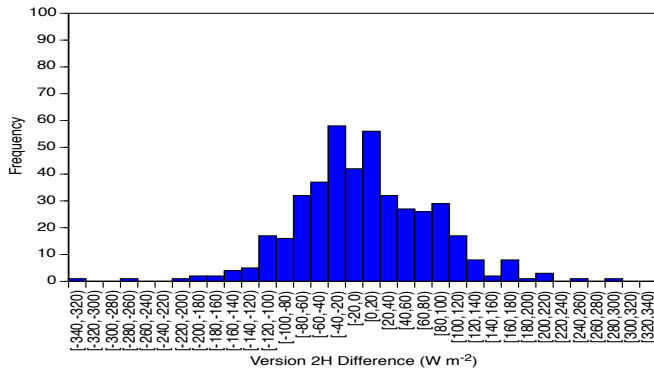
2H

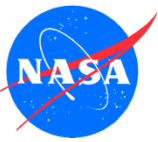
Terra and Aqua

3A



Surface
SW flux
measure-
ments
averaged
+/- 1/2 hour
overpass
time



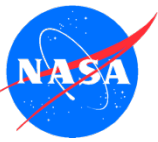


FLASHFlux Data Products

**FLASHFlux Gridded
and Temporally
Averaged Data 2H
Products
(Terra+Aqua; Hourly/
Daily; 1°x1°
resolution;
Processed through
about 3/31/2013)**

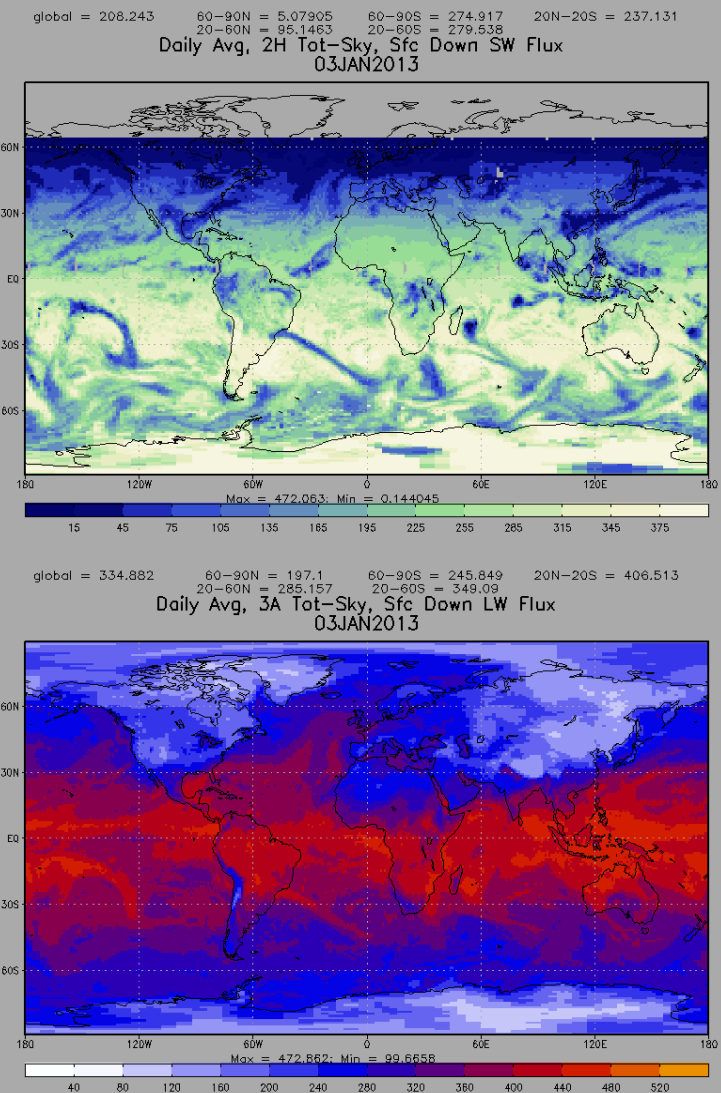
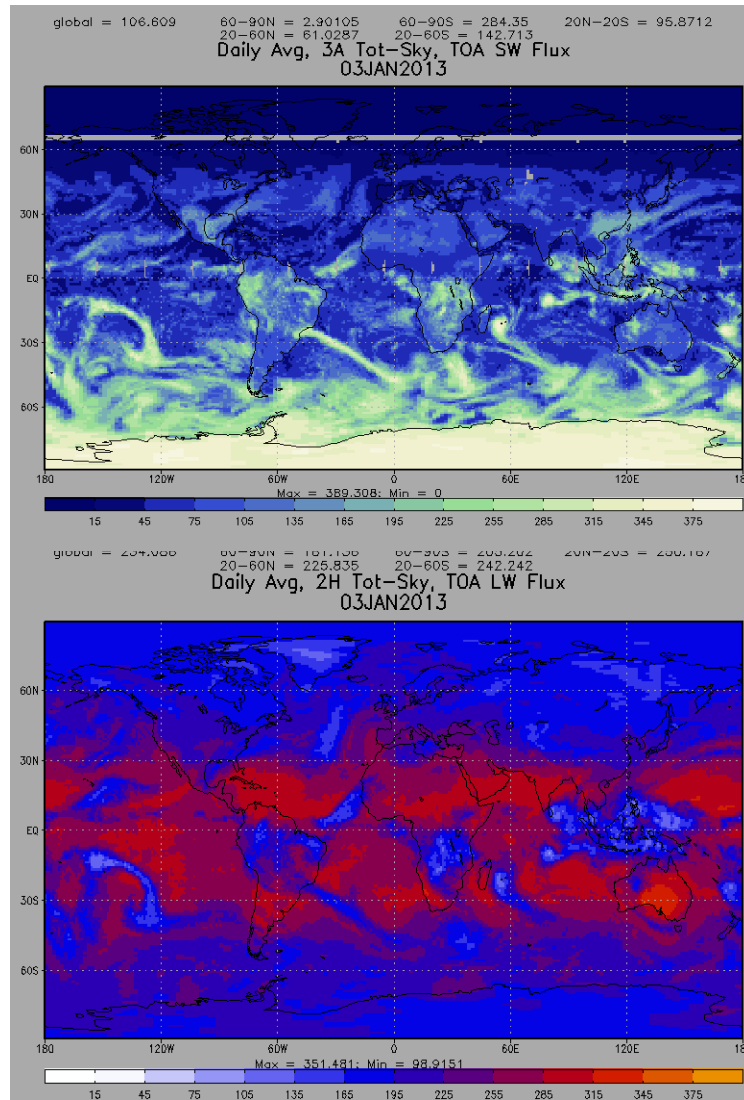
3A not yet available

The screenshot shows the NASA Earth Data website interface for the FLASHFlux data product. The page title is "FLASH_TISA_Terra+Aqua_Version2H". The project title is "CERES", the discipline is "Clouds", and the radiation budget is "Radiation Budget". The version is "Version 2H", the level is "L3", and the platform is "Terra, Aqua". The spatial coverage is "(-90, 90)(-180, 180)", the spatial resolution is "Regional", the temporal coverage is "Jan 1, 2012 - current", the temporal resolution is "Daily", and the file format is "HDF". The order data is "Terra+Aqua_Version2H". The quality summary is "CERES FLASHFlux TISA Version2 Quality Summary". The page also includes a "Browse Images" link and a "Parameters" tab. The footer contains contact information for NASA Official John M. Kusterer, Site Curator NASA Langley ASDC User Services, and a link to the NASA Privacy Statement, Disclaimer, and Accessibility Certification. The last updated date is "Wed May 08 2013 11:51:47 GMT-0400 (EDT)".



FLASHFlux Gridded and Temporally Averaged Data Products (Jan. 3, 2013)

(Terra
+Aqua;
Daily;
1°x1°
resolution)



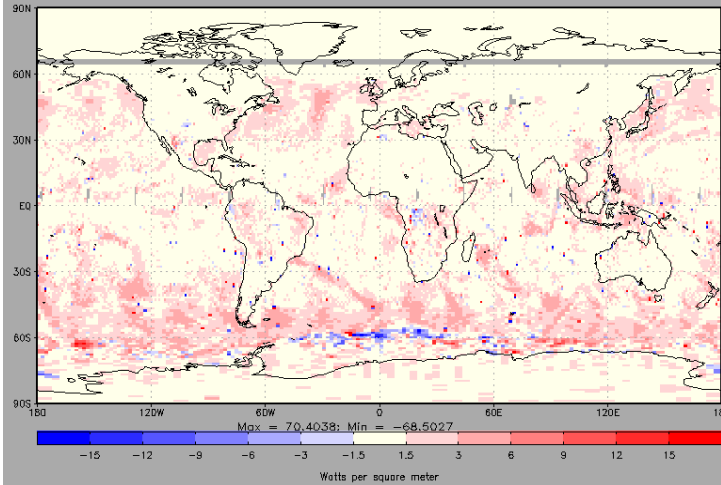


FLASHFlux TISA Product Differences (Jan. 3, 2013)

(Terra
+Aqua;
Daily;
1°x1°
resoluti
on)

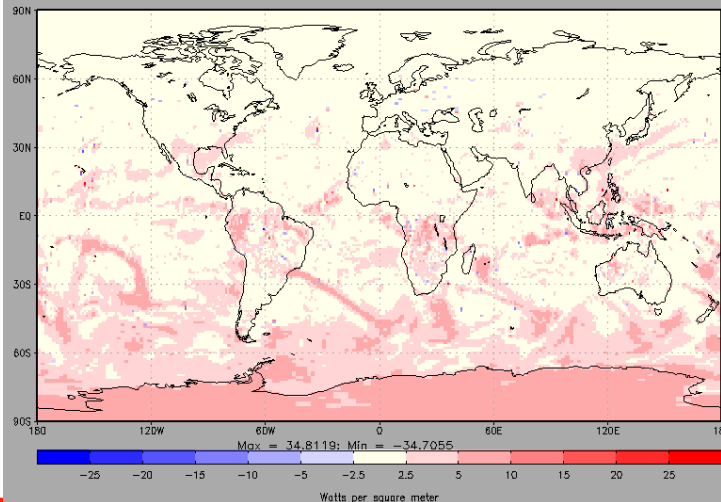
global = 1.0556 60-90N = 0.0753418 60-90S = 1.47905 20N-20S = 1.07123

Daily(3A-2H) Avg, Tot-Sky, TOA SW Flux
03JAN2013



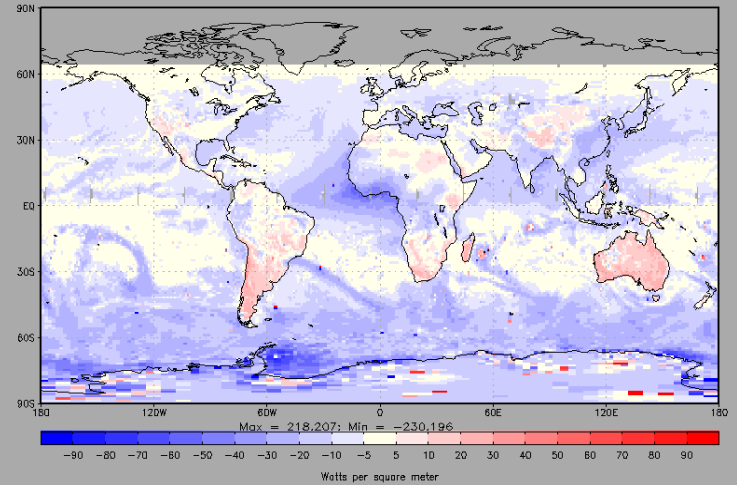
global = 2.10593 60-90N = 0.12023 60-90S = 4.55223 20N-20S = 2.16542

Daily(3A-2H) Avg, Tot-Sky, TOA LW Flux
03JAN2013



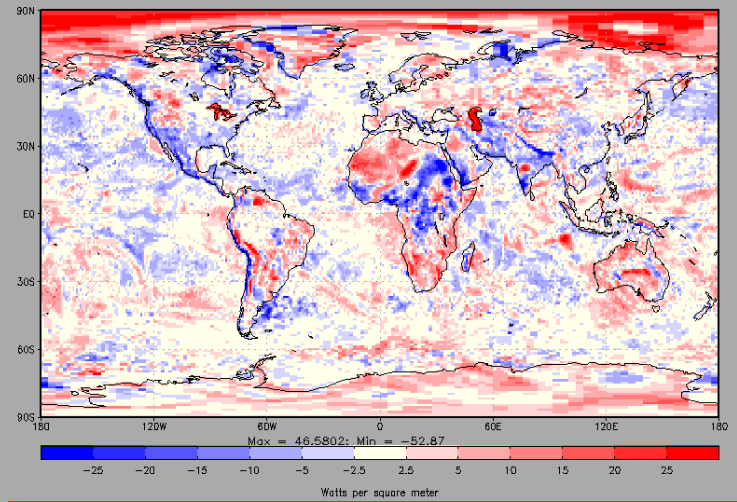
global = -8.50811 60-90N = -2.11124 60-90S = -18.3431 20N-20S = -7.77043

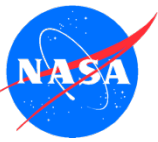
Daily(3A-2H) Avg, Tot-Sky, Sfc Down SW Flux - Mod B
03JAN2013



global = 0.584645 60-90N = 3.78445 60-90S = 1.96233 20N-20S = -0.00533987

Daily(3A-2H) Avg, Tot-Sky, Sfc Down LW Flux - Mod B
03JAN2013





Monitoring and Targeting Case: NASA LaRC Badge and Pass Office



Badge and Pass Office Solar Energy Project



Overview

Current Status

Weather Conditions

Installed in September 2010, this 39.5 KW ground-mounted solar energy system will produce around 50,000 kilowatt-hours of electricity each year. The system consists of 168 photovoltaic modules mounted in two arrays located behind the Badge and Pass Office. This project demonstrates the performance of solar energy and the benefit of renewable energy being in our overall energy strategy.



Energy Today



193
kWh

Total energy generated by the system today

Energy Yesterday



206
kWh

Total energy generated by the system yesterday

Lifetime Energy



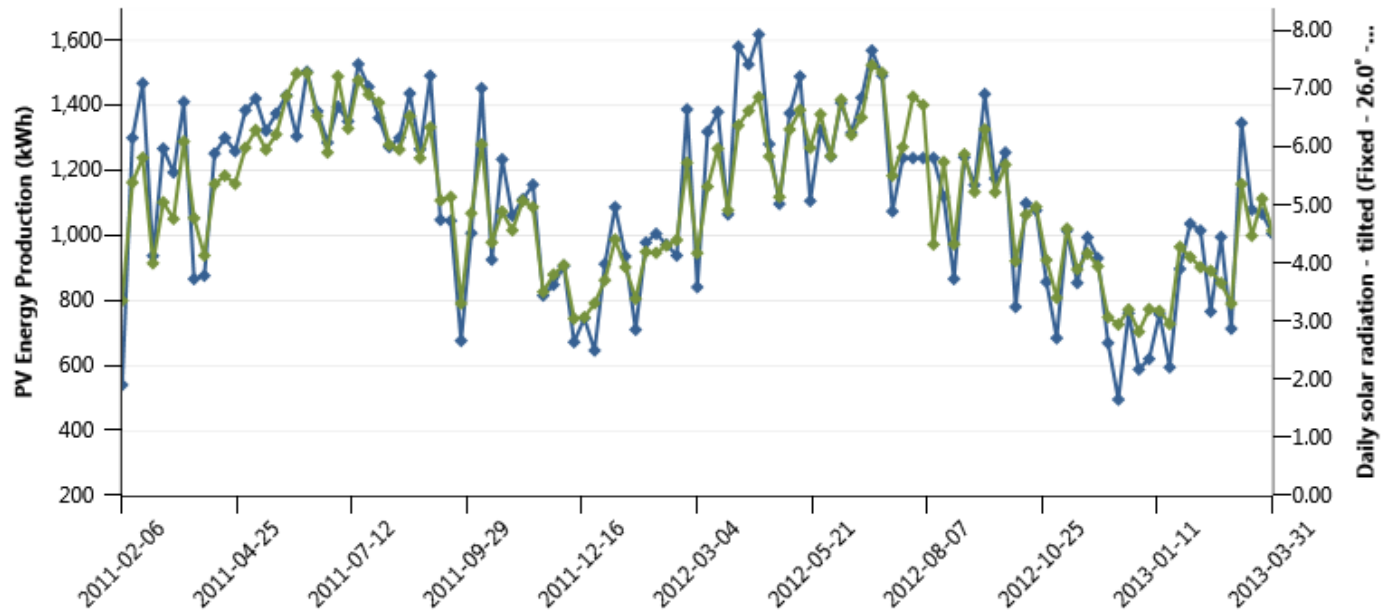
38,035
kWh

Total energy generated by the system since installation

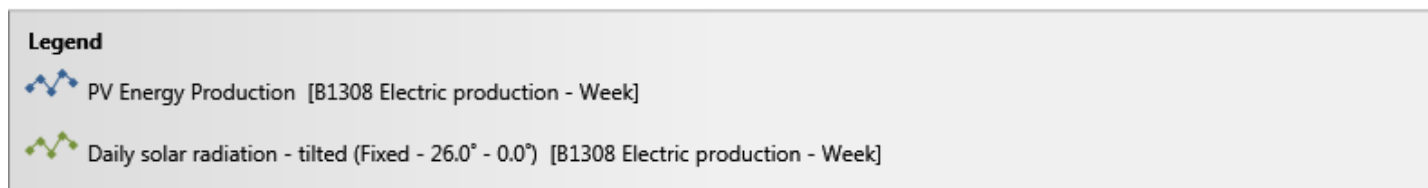


Monitoring and Targeting Case: NASA LaRC Badge and Pass Office

Solar
Panel
Elec-
trical
Output
(kWh)

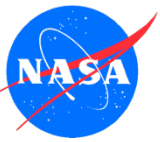


FF 2H
daily
aver-
aged
SW
fluxes



All points represent weekly average of daily inputs

(Results from RETScreen by Rene Ganoë)



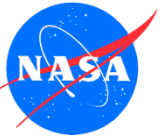
Future Upgrades and Challenges

- *FF data products to CERES subsetter*
- *Continued refinement of algorithms:*
 - SW: Cloudy-sky transmission formula
 - Improve near-real time surface albedos anomalies
 - Aerosols: evaluation FP-IT compared to “Fast-MATCH”
- *Adapt to MODIS Collection 6 (Ed 4 Clouds)*
- *Improve consistency between CERES algorithms and FLASHFlux (TISA/SYN)*
 - Evaluate using GEO?
 - Adapt special version of TISA for monthly averaged maps
- *Develop new products and subsets => parameterizations for the applications like solar industry*



Summary and Conclusions

- ***FLASHFlux publications:***
 - revise SSF paper; write TISA
 - Document SoC => reassess w/ EBAF 2.7
- ***FLASHFlux 3A***
 - Assess and evaluate 3A; validate as possible; complete DQS and promote to operational status
 - Reprocess at least of part of 2012 to provide longer time series with new algorithms and calibration
- ***FLASHFlux Is Working Towards ...***
 - Increasing data accessibility with subsetting
 - Promoting various CERES upgrades for algorithms and subsystems
 - Expanding Applied Science usage



FLASHFlux Web Sites:

<http://flashflux.larc.nasa.gov>